

NPSAT1 Solar Panel Design, Fabrication, and Test

Introduction

NPSAT1 is a low-cost, technology demonstration satellite hosting a number of experiments. Commercial, off-the-shelf (COTS)-based technology will be implemented with custom designs to offer a low-cost command and data handling (C&DH) subsystem building on commercial, desktop PC architecture and standards-based specifications. In addition to an experimental C&DH subsystem, NPSAT1 will demonstrate the use of non-volatile ferroelectric RAM which is inherently radiation-tolerant and lithium-ion polymer batteries, state-of-the-art technology that will be employed offering high energy density (Watt-hr/kg) for space applications.

Experiments on-board NPSAT1 include two Naval Research Laboratory (NRL) payloads. The coherent electromagnetic radio tomography (CERTO) experiment and a Langmuir probe. The CERTO experiment is a radio beacon which, in concert with ground station receivers, is used to measure total-electron-content (TEC) in the ionosphere. The Langmuir probe will augment CERTO data by providing on-orbit measurements. The other experiments are of NPS origin. These include a novel design for a spacecraft computer board, a COTS visual imager (VISIM), and some micro-electromechanical systems (MEMS)-based rate sensors.

Description of Thesis Topic

The NPSAT1 spacecraft in large part utilizes existing hardware, such as the spacecraft structure, solar panels, and possibly the launch vehicle interface (depending on the eventual carrier interface). However, because the NPSAT1 mission requirements are different than those of the spacecraft from which the existing hardware derives, configuration changes are necessary. This includes the addition of solar panels to the structure, modification to the layout of the existing panels, and modifications to the overall structure, including the addition of a tip mass for mass distribution (mass moment of inertia). The scope of this thesis should define the layout of the additional solar panels into the existing solar array, including structural support and interfaces, fabrication of the panels, and testing of the panels for functionality and workmanship (vibration and thermal-vacuum cycling).

Proposed Outline

- NPSAT1 Introduction
- Solar Panel Array Requirements
- Design of Solar Panels
- Fabrication and Testing
- Conclusions & Recommendations
- Appendix of Test Results and Test Data

Suggested References

- *Solar Cell Array Design Handbook*, Vol. 1 & 2, JPL, Oct. 1976.
- Test Requirements for Space Vehicles, MIL-STD-1540B, Oct. 1982.
- Application Guidelines for MIL-STD-1540B, MIL-HDBK-340, July 1985.